

Magnetic Levitating Hover Board to Work as a Forklift

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ABSTRACT

Nowadays storing or retrieving goods from warehouses etc. there is use of forklifts extensively. They play a vital role in reducing manual labor to a great extent. It has one shortcoming in the fact that it cannot access small spaces. There is also need skilled personal to operate the vehicle. Apart from these things forklifts also get damaged due to lack of maintenance. The main objective of this magnetic levitating hover board is to access all kinds of spaces inside the workshops and further reduce human effort by using magnetic levitation principle to create a lift to assist in hovering of goods over a copper surface. Hover board is built, which makes it easy to move around heavy objects inside the workshop with minimal effort and more efficiently decreasing the time consumed in the whole process. Electronic speed controller is used to control the rpm of motor which is used to rotate the discs that contain the N52 magnets.

KEYWORDS: Halbach array, Magnetic levitation, brushless DC motor, Electronic speed controller, N52 magnets, Lithium polymer battery

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I. INTRODUCTION

In today's world the arrangement or pick up and placement of goods is done using cranes (i.e. in construction sites or basically in the outdoors) and forklifts (i.e. in storage units or basically in doors we talk about forklifts, it gets most of the work done but the major disadvantage is that they are difficult to operate in smaller places of the storage unit or workshop. Still, today humans do the work of moving the goods in smaller places. There are machines that make the work a little less difficult but it still requires human effort.

Hence, this project proposes a hover board that would decrease human effort if implemented in the places where the forklifts don't work well. This hover board is based on the principle of magnetic levitation, which uses permanent magnets fitted in a circular disc using halbach array arrangement and when these discs are spun at high speed it generates current in the copper plate placed below these magnets, which in return will produce opposing magnetic field and create a lift.

II. PROBLEM STATEMENT

The current scenario in the manufacturing industry is that implementation of autonomous forklifts require a high initial investment, while also taking high effort in terms of maintenance. The breakdown of a single part will cause maintenance breaks of long hours until the machine is repaired, which is a thing the companies cannot afford and can cause huge amounts of loss if this happens frequently.

The current problems related to forklifts that are being dealt with are mast, steering, starting problems and to avoid these kinds of problems maintenance needs to be done regularly. These problems are eliminated in our proposed model, as there will be no use of any of those system components (mast, steering).

III. MOTIVATION

- The main motivation is to provide all the initial cost and the installation of this system is minimum.
- The Magnetic levitation, the system can be elevated to the next level, which helps the users to utilize their investment in an economic manner.
- This Magnetic levitating hover board minimizes manpower and efficiently utilizes the energy resources available, ultimately leading to more profit.

IV. LITERATURE SURVEY

In [1], Lithium polymer batteries are high-powered lithium batteries used for electric vehicles and also in unmanned micro air vehicles. They have high energy density, high over current rating and can deliver several times the rated current of the battery. This paper presents the performance of lithium polymer battery when a brushless dc motor is connected as load and how the performance is enhanced when super capacitor is connected along with the battery to feed the load.

In [2], the focus is on the power electronics design considerations, specifically on the most power hungry electronic modules on a drone, i.e. electronic speed controller (ESC). Based on power electronics theory, power loss and flight time estimation models on the 3-phase motor driver, using state-of-the-art Silicon-based Insulated Gate Bipolar Transistor (Si-IGBT), emerging wide-bandgap semiconductor duals, i.e. silicon carbide (SiC) and Gallium Nitride (GaN) power transistors models are computed and compared.

In [3], this identifies the electromagnetic/dynamic correlation between the levitation and guidance systems using a magnetic equivalent circuit and motion equations. Using the analysis of the coupling effect, a controller is designed and verified its performance through simulations.

In [4], a novel topology of dual rotor radial flux-BLDC motor with Halbach array magnets as an efficient solution for drives is shown. Energy saving motors are a necessity of today for electric vehicles, industrial and consumer products. Moreover this concept is known to cater for the requirements of electrical vehicle. Due to beginning of high permeability, high saturation magnetic materials, high-energy product permanent magnets, BLDC motors are suitable contender for electric vehicle thrust

V. PROPOSED MODEL

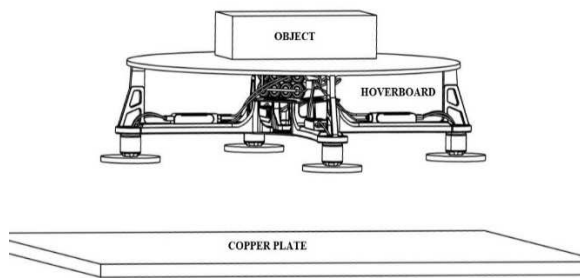


Fig1. Component diagram

The proposed component diagram consists of different components like BLDC motor, Li-Po battery, N52 Neodymium magnet Disc, Electronic Speed Controller, Servo Tester and Copper Plate. Initially the N52 Neodymium magnet discs rotate with the help of BLDC motors. These motors are powered by a Li-Po battery and Electronic Speed Controller, which converts AC Battery voltage to DC input required for the motor and controls the rpm of motors with the help of servo testers. The servo testers are to be connected with the ESC in order to control the input voltage to the motor and as a result control the rpm of motor. This prototype can be made on a larger scale.

VI. COMPONENTS:

1. Motor Selection:

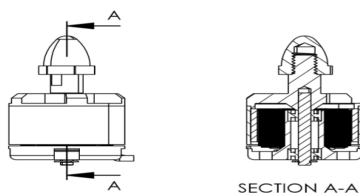


Fig: DJI BLDC Motor

The subsequent criteria has been used for the choice of motor: Brushless DC (BLDC) Motor has been selected according to its kV rating.

A 920 kV motor has been designated. KV suggests that revolutions per minute per V. The battery is 14.4vKV i.e. $920\text{kv} \times 14.4\text{v} = 13248$ revolutions per minute. Hence, the revolutions per minute it will offer is enough for our demand.

2. Battery selection:

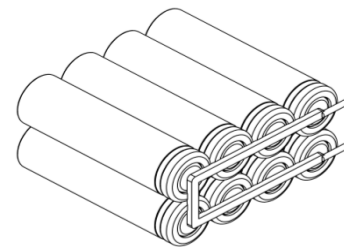


Fig: Orange, Li-Po Battery

Battery is chosen on the premise of volts, discharge rating(C), No. of cells

Our battery is 14.4 v.

Discharge rating (C): 100C/200C i.e. the battery has 100C however it will offer 10 sec boost of 200C No of cells: Four

3. Electronic speed Controller

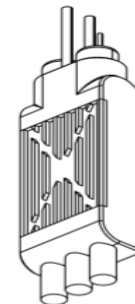


Fig: Electronic Speed Controller

ESC selected is based on amps rating and no of battery cells required. We have selected an ESC, which has 30 amps rating and supports our 4-cell battery.

4. Orientation of magnets

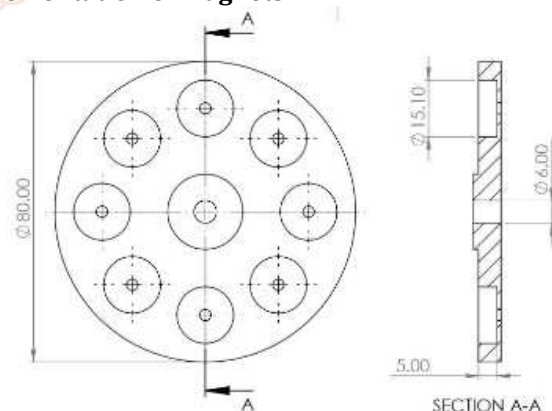


Fig: Disc containing magnets

One of the halbach array's orientation is that all the magnet's poles are placed in alternate manner i.e. one's north pole facing down and the next one's north pole facing up.

This gives a halbach array arrangement with the increased magnetic field on the North Pole side.

The N52 magnets have placed in a Disc shown above

5. Frame Selection:

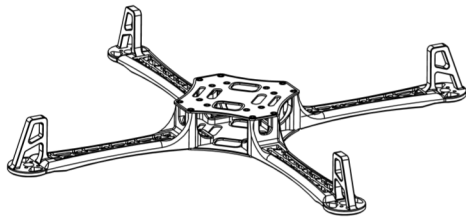


Fig: F450/550 Frame

The selected frame is a standard F450/550 Quad copter drone frame. This frame is strong light weight which decreases the self-weight of the model. This gives adequate amount of space for mounting all the components and also has the right arrangement for placing the motors.

VII. ASSEMBLY

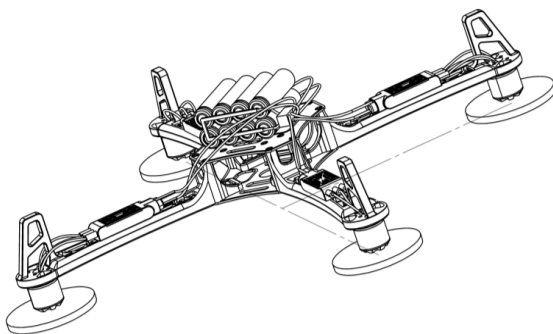


Fig: Isometric View

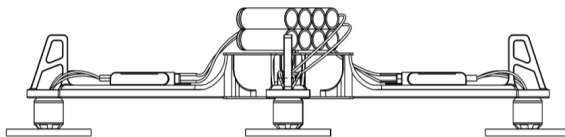


Fig: Side View

VIII. CONCLUSION

The development of a Magnetic Levitating hover board, using components like N52 Magnets, BLDC motors, Li-Po battery and ESC. The proposed system not only reduces human effort but also increases work efficiency by decreasing the time and energy resources consumed. So automatically, the initial cost of system installation and maintenance cost will be reduced providing high return on investment.

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